

## Claims

What is claimed is:

1. 1. A method to control the level of addition of a chemical treatment to a main flow of a fluid wastestream being treated thereby, for a particular purpose, comprising:
  2. a. forming a side stream from said main flow at a diverting point;
  3. b. determining the flow rate of said main flow;
  4. c. adding said chemical treatment at a first addition point of said side stream, at a level of addition based principally on proportionality to said wastestream's main flow flow rate;
  5. d. measuring, at a first measuring point downstream from said first addition point, the concentration of said chemical treatment in said side stream;
  6. e. adding said chemical treatment at a second addition point of said side stream, at a level of addition based principally on the difference between the level of addition at said first addition point and the concentration measured in step 'd,' and
  7. f. returning said side stream to said main flow of said wastestream downstream of said diverting point;  
8. whereby said wastestream thereby is provided with a desired level of chemical  
9. treatment additions to achieve said particular purpose.
10. 2. The method of claim 1, wherein said chemical treatment comprises chlorine dioxide.
11. 3. The method of claim 1, wherein said measuring is conducted between said first  
12. addition point and said second addition point.
13. 4. The method of claim 1, wherein said measuring is conducted downstream of said first  
14. addition point and said second addition point.
15. 5. The method of claim 1, wherein said adding at said first point is determined by an

2 algorithm that has, as its principal variable, a parameter change indicative of the flow  
3 rate of said main stream.

1 6. The method of claim 1, wherein said adding at said second point is determined by an  
2 algorithm that has, as its principal variable, a parameter change indicative of reaction  
3 of said chemical treatment with one or more components in said side stream.

1 7. The method of claim 1, additionally comprising sending data signals of said  
2 measuring, step d, to a computational control device, and sending control signals from  
3 said computational control device to a second addition point control device that  
4 controls the rate of said adding of said chemical treatment at said second addition  
5 point.

1 8. The method of claim 7, additionally comprising sending data signals of said  
2 determining, step b, to said computational control device, and sending control signals  
3 from said computational control device to a first addition point control device that  
4 controls the rate of said adding of said chemical treatment at said first addition point.

1 9. The method of claim 1, additionally comprising sending data signals of said  
2 determining, step b, to a computational control device, and sending control signals  
3 from said computational control device to a first addition point control device that  
4 controls the rate of said adding of said chemical treatment at said first addition point.

1 10. The method of claim 9, additionally comprising sending data signals of said  
2 measuring, step d, to said computational control device, and sending control signals  
3 from said computational control device to said second addition point control device  
4 that controls the rate of said adding of said chemical treatment at said second addition  
5 point.

- 1    11. A system for dosing a main flow of a liquid in need of chlorine dioxide treatment
- 2        with chlorine dioxide, comprising:
  - 3            a. a side stream diverting from said main flow of said liquid, comprising:
    - 4                1. a diverting point that provides an intake for liquid into said side stream from  
5                said main flow;
    - 6                2. a first addition point at which a first addition of chlorine dioxide is added to  
7                said side stream, said first addition principally proportional to the flow rate of  
8                said main flow;
    - 9                3. a second point at which a second addition of chlorine dioxide is added to said  
10              side stream, said second addition principally adjusted based on data signals  
11              from a primary measuring device, wherein said device measures a parameter  
12              in said liquid indicative of a reaction between said chlorine dioxide and  
13              component(s) in said liquid; and
    - 14                4. a returning point positioned downstream of said diverting point, through  
15              which liquid in said side stream returns to said main stream;
  - 16            b. said primary measurement analyzer, positioned downstream of said first addition  
17              point, and providing data of said measurement of said change, said data being used to  
18              set said second addition; and
  - 19            c. at least one computational control device, receiving signals indicating said flow  
20              rate of the main stream and using said signals to control the first addition according to  
21              a first algorithm, and receiving data from said primary measurement analyzer, and  
22              using said data to adjust the second addition according to a second algorithm,  
23              wherein said side stream controller provides sufficient chlorine dioxide addition to  
24              achieve a desired purpose in the fluid in the main stream.
- 1    12. The system of claim 11, wherein the sample point of said primary measurement  
2        analyzer is positioned along the side stream after the first and the second addition  
3        points.

1       13. The system of claim 12, additionally comprising a secondary point of measurement,  
2           wherein the sample point of said secondary point of measurement is positioned in the  
3           main stream after the returning point.

1       14. The system of claim 11, wherein said primary measurement analyzer measures the  
2           level of chlorine dioxide.

1       15. The system of claim 11, wherein said first algorithm is **P1DR = (a)ODR**, where:  
2           P1DR is a dose rate at said first addition point; *a* is the nominal fraction of the total  
3           chlorine dioxide addition that is provided at said first addition point, and ODR is a  
4           predetermined target dose rate, and wherein the dose rate P1DR at said first addition  
5           point is added based on dilution into the main flow as determined by periodic, semi-  
6           continuous, or continuous measurement of said main flow.

1       16. The system of claim 11, wherein said second algorithm is **P2DR = (b)ODR + (P1DR**  
2           – X)(F), where P1DR is a dose rate at said first addition point, ODR is a  
3           predetermined target dose rate, *b* is the nominal fraction of the total addition of  
4           chlorine dioxide at said first and second addition points, where *a* + *b* = 1.0, X is data  
5           output from primary measurement analyzer, P2DR is dose rate at said first addition  
6           point; and F is a selected adjustment factor, and wherein the dose rate P2DR at said  
7           second addition point is added based on dilution into the main flow as determined by  
8           periodic, semi-continuous, or continuous measurement of said main flow.